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and fresh water. All three forms abound at Wood's Holl, and vicinity. The fresh-water ponds are numerous, and many of them, both on the mainland and on the neighboring islands, are *completely isolated* and stocked with forms in-bred for centuries. Brackish water in almost every degree, pure sea-water and tide-currents are right at hand.

Land is the next essential, and here we have hill, plain, marsh, swamp, shore and islands, and some of these islands are inimitable biological farms of nature's own make.

A seasonable range of temperature is essential to the existence of a majority of the forms best suited to cultivation and study; and in this are supplied very important conditions for experimental work. The surrounding sea protects Wood's Holl from extremes of heat and cold.

Isolation.—The most favorable combination of conditions may be utterly worthless, unless the farm can be made secure in its isolation from the public. Its work must go on in a *quiet environment*, where all the conditions are under control, and the investigator is free from the danger of intrusion.

Mode of Development.—The work should be developed slowly, section by section, each section consisting of a group of related species, or a single species, offering a wide range of problems.

Each section should be in charge of a director, prepared to continue the work during life, and supported by assistants and help for all routine and mechanical service. The staff would consist of directors, assistant investigators, artists, photographer, clerical help, keepers and a business manager.

Outlay and Maintenance.—The original outlay for land, stock, buildings, equipment, inclosures of land and water for isolation purposes, would vary according to the

forms selected for study. From \$50,000 to \$100,000 would suffice for this. The maintenance of the first section, including salaries, accessions to stock, library, etc., may be estimated at \$10,000 a year. The cost of additional sections would be about \$5,000 each.

Ideal Center.—The association of three such institutions as the Marine Biological Laboratory, the U. S. Fish Commission Station, and a Biological Farm would form an ideal biological center. Each would help and be helped by the other two.

Cooperation.—There should undoubtedly be several biological farms in the country. The larger universities might well have their own farms, and thus very extensive and effective cooperative work be carried on.

Use to Science.—The farm would enable us to approach all the fundamental problems of life from the two sides of observation and experiment on living organisms. It would furnish material for study with precise records, and make it possible to keep up continuity in the experimental study of heredity and variation.

Practical Utility.—The utility of such work is seen when we reflect on the practical results already realized in the multiplication and improvement of domestic species of animals and plants through cross-breeding, hybridisation and selection. We have very meager and uncertain knowledge of the laws of heredity and variation—laws which underlie all progress of the race.

C. O. WHITMAN.

SCIENTIFIC LITERATURE.

Manual of Astronomy, a text-book. By CHARLES A. YOUNG, Ph.D., LL.D. New York, Green & Company.

The preface to this volume informs us that it has been prepared in response to a rather pressing demand for a text-book intermediate

between the author's 'Elements of Astronomy' and his 'General Astronomy.'

It is perhaps an open question whether the fact that a text-book contains more matter than can be mastered in the time allotted to the subject constitutes a valid objection to its use, or a legitimate demand for a book of less dimensions. To bring home to the student in this practical way the fact that some things still remain to be learned undoubtedly has a salutary effect in some cases.

Be that as it may, we have here an excellent book. To those acquainted with the author's 'General Astronomy,' the pages present a familiar appearance, suggestive of a simple abridgment of the larger work. A more careful examination, however, shows that we have much more than this. No inconsiderable portion has been rewritten with the introduction of new matter and illustrations and all brought strictly up to date. We mention a few of the many cases in point. The very satisfactory account of the planet Eros; the reference to Belopolsky's spectroscopic researches on the rotation period of Venus; the application of the results of the investigations of Nichols, Hall and Lebedew on the repulsive action of the solar radiation to the formation of comets' tails, and the story of the Nova Persei.

If any mistakes or errors exist they have escaped the notice of the reviewer.

C. L. D.

SOCIETIES AND ACADEMIES.

AMERICAN MATHEMATICAL SOCIETY.

THE Ninth Summer Meeting of the American Mathematical Society was held at Northwestern University, Evanston, Ill., on Tuesday and Wednesday, September 2-3, 1902. About fifty persons were in attendance, including thirty-nine members of the Society. Two sessions were held on each day. The President of the Society, Professor Eliakim Hastings Moore, occupied the chair at the opening session, being succeeded by Professor T. S. Fiske and Professor H. S. White. The following persons were elected to membership in the Society: Professor T. J. F'a. Bromwich, Queen's College, Galway, Ireland; Mr. J. S.

Brown, New York City; Professor G. C. Edwards, University of California, Berkeley, Cal. Eight applications for membership in the Society were received.

A committee consisting of Professors H. W. Tyler, T. S. Fiske, W. F. Osgood, J. W. A. Young and Alexander Ziwet was appointed to consider and report on standard definitions of requirements in mathematical subjects for admission to college and scientific schools. This committee will cooperate with those recently appointed by the National Educational Association and the Society for the Promotion of Engineering Education.

President Moore, Professor F. Morley and Dr. Emory McClintock were appointed a committee on the nomination of officers of the Society for the coming year.

The recently organized Pacific Section of the Society received the official designation of the 'San Francisco Section.'

Pleasant social features of the meeting were the dinner at Northwestern University on Tuesday evening and a gathering in Chicago on Wednesday evening. Resolutions appreciative of the hospitality of the University were adopted at the close of the meeting.

The scientific program comprised the following thirty-two papers:

- (1) Dr. F. R. MOULTON: 'A method of constructing general expressions for the elements of the planetary orbits which are valid for a definite time.'
- (2) Professor A. S. HATHAWAY: 'The quaternion treatment of the problem of three bodies.'
- (3) Dr. J. V. COLLINS: 'A general notation for vector analysis.'
- (4) Professor L. E. DICKSON: 'Definitions of a linear associative algebra by independent postulates.'
- (5) Professor L. E. DICKSON: 'Two definitions of a field by independent postulates.'
- (6) Dr. E. V. HUNTINGTON: 'Definitions of a field by sets of independent postulates.'
- (7) Dr. OTTO DUNKEL: 'Regular singular points of a system of homogeneous linear differential equations of the first order.'
- (8) Professor OSKAR BOLZA: 'Some instructive examples in the calculus of variations.'
- (9) Professor J. B. SHAW: 'On linear associative algebras.'